



# MGS-402

## MGS-402 Gas Detection Controller *for Commercial & Industrial Applications*



### Fixed Gas Detection

P/N: 1100-2570 | March 2020 Revision 1

### User Manual

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# 1. Introduction

## 1.1 About this Manual






Thank you for investing in a Bacharach MGS-402 Gas Detector Controller. To ensure operator safety and the proper use of the controller, please read the contents of this manual for important information on the operation and maintenance of the instrument.



**IMPORTANT:** Before using this product, carefully read and strictly follow the instructions in the manual. Ensure that all product documentation is retained and available to anyone operating the instrument.

## 1.2 Conventions

### 1.2.1 Iconography

Alert	Icon	Description
<b>DANGER</b>		Imminently hazardous situation which, if not avoided, will result in death or serious injury.
<b>WARNING</b>		Potentially hazardous situation which, if not avoided, could result in death or serious injury.
<b>WARNING</b>		Potential electrical shock hazard which, if not avoided, could result in death or serious injury.
<b>CAUTION</b>		Potentially hazardous situation which, if not avoided, could result in physical injury or damage to the product or environment. It may also be used to alert against unsafe practices.
<b>IMPORTANT</b>		Additional information on how to use the product.

## 1.3 General Safety Statements



**DANGER:** This instrument is neither certified nor approved for operation in oxygen-enriched atmospheres and / or hazardous locations. Failure to comply may result in personal injury or death.



**WARNING:** Always remove AC power before working inside the MGS-402 enclosure and exercise extreme care when accessing the products interior. Only qualified electrical maintenance personnel should perform connections and adjustments.



**CAUTION:** The protection provided by this product may become impaired if it is used in a manner not specified by the manufacturer. Modifications to this instrument, not expressly approved, will void the warranty.



**CAUTION:** In case of malfunction, DO NOT continue to use this equipment if there are any symptoms of malfunction or failure. In the case of such occurrence, de-energize the power supply and contact a qualified repair technician or the nearest Bacharach Service Center.



**CAUTION:** Use ONLY the provided cable glands for electrical and communication wiring. Drilling into the box will void the warranty.

# 2. Product Description

## 2.1 Product Overview

The MGS-402 Gas Detection Controller displays centralized information about the status of connected MGS-410 gas detectors. The MGS-402 is connected to the MGS-410s via Modbus RTU.

The MGS-402 can be used to provide power to each connected MGS-410 gas detector, negating the need for separate power supply at the location of the gas detector.

The MGS-402 displays status via a bank of LEDs that represent the channel/sensor connected to it. Each channel/sensor has a row of dedicated LEDs to indicate the status of the sensor:

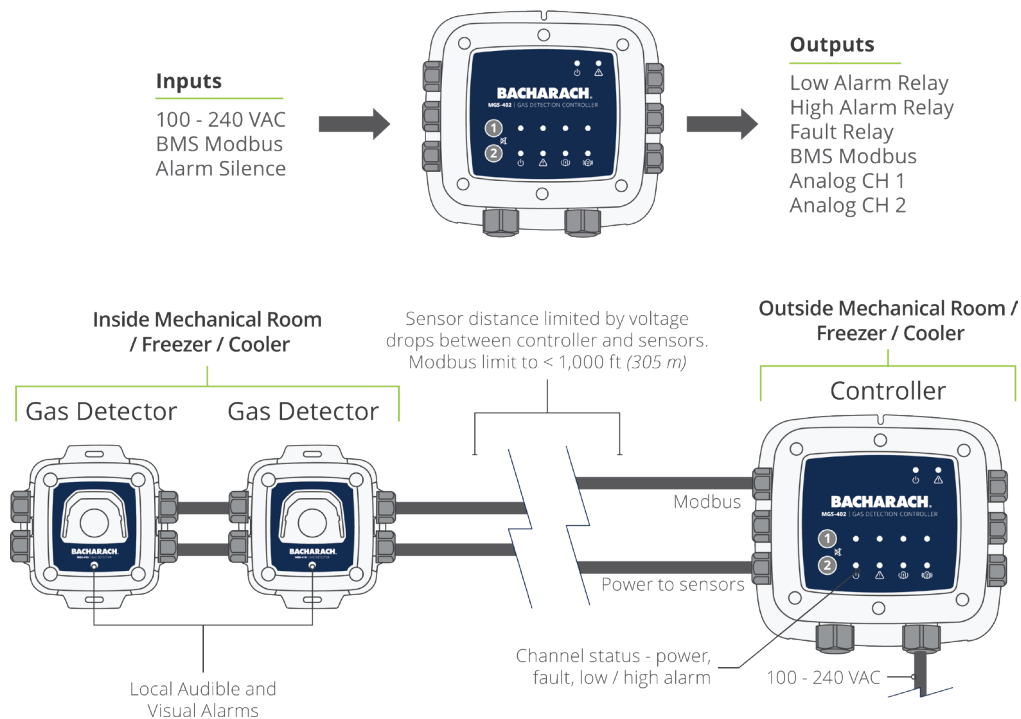
- Power • Fault • Low alarm • High alarm

The MGS-402 provides three relays (*fault, low and high alarm status*) for connection to auxiliary systems, ventilation or other equipment.

The MGS-402 has an integrated visual alarm of LEDs around the perimeter of the controller that will activate when a low or high alarm is received from either channel. In addition, the integrated audible alarm will activate in the same manner.

In addition to being a Modbus master to the MGS-410 gas sensors, the MGS-402 acts as a Modbus slave for ease of integration into a building automation system (BMS) or programmable logic controller (PLC). The controller also features two analog outputs which may enable monitoring gas detector levels remotely.

**Figure 2-1 -** The MGS-402 Gas Controller System





**WARNING:** This instrument is neither certified nor approved for operation in oxygen-enriched atmospheres. Failure to comply may result in EXPLOSION.



**WARNING:** For your safety, DO NOT use this instrument in locations classified as hazardous because it has not been designed for such areas.

## 2.2 Intended Use

The MGS-402 provides audio-visual alerts and information pertaining to the status of a centralized gas detector network. This information allows concise, at-a-glance notification of any alarm or fault status regarding a connected gas detector located outside the monitored space, as required by industry safety standards (*EN 378, ASHRAE 15*).

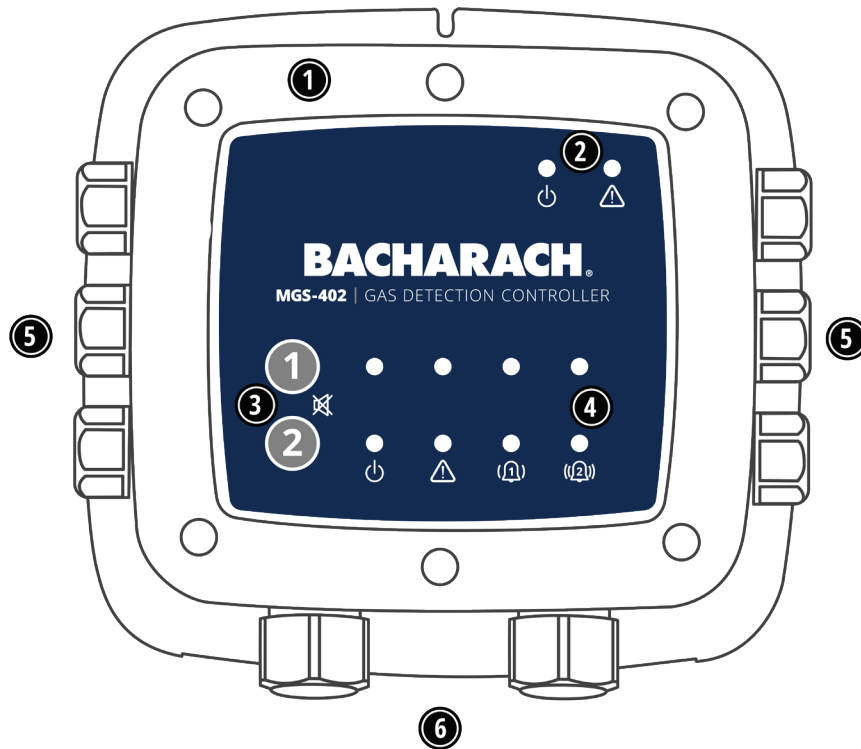
## 2.3 Design Features

Power options	100 - 240 VAC, 50/60 Hz, 20 W (max.) Provides power for up to (2) MGS-410 Bacharach gas detectors
Output/ Communications	RS485 Modbus RTU Master for Gas Detectors RS485 Modbus RTU Slave for BMS Diagnostic/status LEDs <ul style="list-style-type: none"> <li>• Controller (<i>power, fault</i>)</li> <li>• Gas detectors (<i>power, fault, low alarm, high alarm</i>)</li> </ul> Configurable output options <ul style="list-style-type: none"> <li>• 3 × relays (<i>fault, low alarm, high alarm</i>)</li> <li>• 2× Analog outputs (<i>4-20 mA, 1-5 V or 2-10 V</i>)</li> </ul> Integrated high output visual strobe Integrated high output audible alarm Remote silence input ( <i>In addition to silence on the on the controller input.</i> )



## 2.4 Front Panel

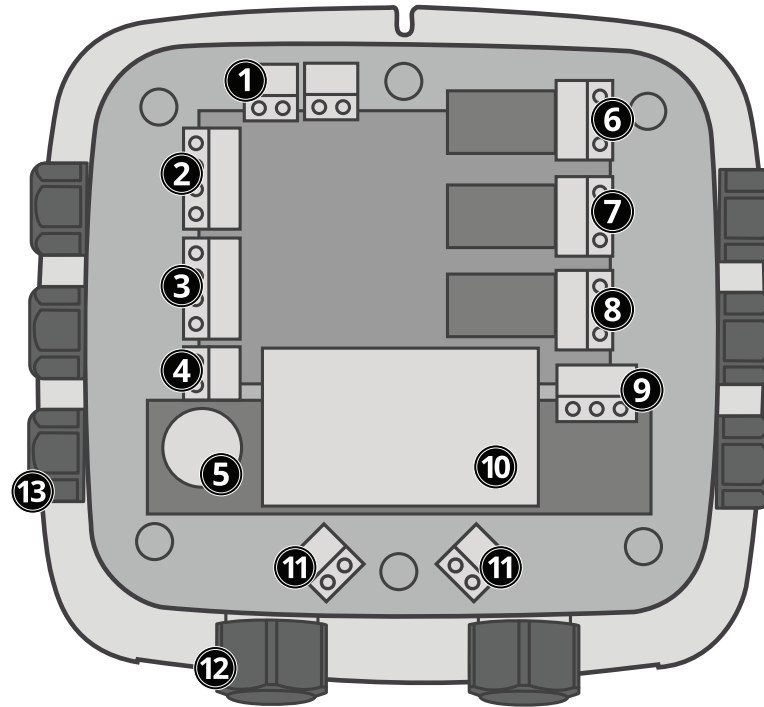
Figure 2-2 - Front Panel Layout



#	Front Panel Description
1	Integrated visual alarm in bezel
2	Controller Power & Fault LEDS
3	Channel 1 and 2 mute alarm buttons
4	Power, Fault, Low Alarm, High Alarm LEDS; each channel
5	M16 Cable Glands (×6)
6	M20 Cable Glands (×2)

## 2.5 Components

Figure 2-3 - MGS-402 Layout



#	Component Description	#	Component Description
1	Analog Outputs (×2)	8	Low Alarm Relay
2	Modbus to Gas Detectors	9	AC Power Line Input
3	Modbus to BMS	10	Power Supply
4	Remote Silence	11	Sensor Power Connections (×2)
5	Audible Alarm	12	M20 Cable Glands (×2)
6	Fault Relay	13	M16 Cable Glands (×6)
7	High Alarm Relay		

## 2.6 Communication Features

The MGS-402 Gas Detection Controller features full two-way communications via an RS-485 interface. Modbus RTU is the communication protocol standard.

The controller is configured as a Modbus master and can be the centralized controller for a two sensor gas network and also has a Modbus slave port for connection to a BMS / fire safety panel for a complete gas detection solution.

# 3. Installation

## 3.1 Warnings & Cautions



**WARNING:** Explosion hazard! Do not mount the MGS-402 Gas Detection Controller in an area that may contain flammable liquids, vapors or aerosols. Operation of any electrical equipment in such an environment constitutes a safety hazard.



**WARNING:** Electrical installation should be performed by a certified electrician, and should comply with all applicable NEC / CEC and local electrical safety codes.



**WARNING:** Shock hazard! Always turn off AC power before working inside the monitor.



**CAUTION:** Drilling holes in the MGS-402 Gas Detection Controller enclosure may damage the unit and will void the warranty. Please use provided cable glands for electrical connections.



**CAUTION:** The MGS-402 Gas Detection Controller contains sensitive electronic components that can be easily damaged. Be careful not to touch or disturb any of these components.

## 3.2 Preliminary Inspection

The MGS-402 Gas Detection Controller has been thoroughly inspected and tested prior to shipment from the factory. Nevertheless, it is recommended that the instrument be re-checked prior to installation. Inspect the outside of the enclosure to make sure there are no obvious signs of shipping damage. Remove the top of the enclosure. Visually inspect the interior of the enclosure for loose wires or components that may have become dislodged during shipment. If damage is discovered, please contact a qualified repair technician or the nearest Bacharach Service Center for assistance.

## 3.3 Suitable / Appropriate Locations

The MGS-402 Gas Detection Controller is design for use in a small gas detection network that could be in mechanical rooms, warehouses, cold storage or freezers to help comply with international safety standards (*EN 378, ASHRAE 15, CSA-B52*). The MGS-402 is a NEMA 4X (*poly carbonate*) or IP66 rated enclosure and can be placed in environments from -40 °C to +50 °C ambient temperatures. Typical installations would be either inside or outside the door of an enclosed space to have local audible and visual alarms as required by safety standards.

The MGS-402 is not intended for installation in classified locations.

## 3.4 Mounting the Gas Detection Controller



**NOTE:** A certified AC power disconnect or circuit breaker should be mounted near the controller and installed following applicable local and national codes. If a switch is used instead of a circuit breaker, a properly rated CERTIFIED fuse or current limiter is required to be installed as per local or national codes. Markings for positions of the switch or breaker should state (I) for on and (O) for off.



**WARNING: DO NOT** allow the lid / sensor to hang from the ribbon cable. Failure to comply may result in damage to the product.

1. Mount the MGS-402 according to the product dimensions, maximum wiring lengths and following considerations:
  - Environment: the full range of environmental conditions when selecting a location.
  - Application: the specifics of the application (*possible leaks, air movement / draft, etc.*) when selecting a location.
  - Accessibility: the degree of accessibility required for maintenance purposes when selecting a location.
2. Using a 5/32" (4 mm) hex key / allen wrench (*not included*) remove the lid and disconnect the ribbon cable from the base.
3. Set the lid and rubber gasket aside to be reinstalled later.

## 3.5 Power Wiring

### 3.5.1 Connecting the Main (100-240 VAC) Power

The MGS-402 controller features (2) M20 cable glands (*item 12 in "Figure 2-3 - MGS-402 Layout" on page 7*) that are intended for power entry / wiring.



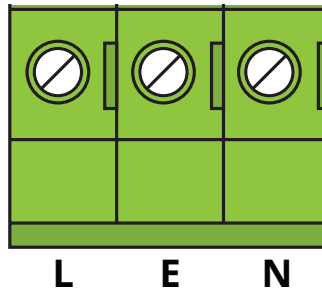
**WARNING:** Copper conductors for connection to main power supply and output relays must be made in accordance with local building codes.

Locate the AC power input terminal block (*item 9 in "Figure 2-3 - MGS-402 Layout" on page 7*) and remove it from the controller.

4. Ensuring that the main power is turned off at the upstream circuit breaker or disconnect switch, feed the incoming power leads through one of the M20 glands and into the appropriate terminals (*L (Live) – black/brown, E (Earth) – green, N (Neutral) – white / blue*) on the terminal block.

5. Plug the power terminal block back into the printed circuit board (PCB).

Figure 3-1 - Power Terminal Block



## 3.6 Sensor Output & Modbus Connections

### 3.6.1 MGS-402 Gas Detection Controller Network

The MGS-402 Modbus communications network is connected to the MGS-410 gas detectors using a shielded twisted pair instrument cable (*Belden 3106A or equivalent*). The same type of cable can be used for power connection when using the MGS-402 controller as the power source (+24VDC) for the MGS-410 gas sensors and standard Modbus network limits. Care needs to be taken to account for voltage drops between the controller and the MGS-410 gas sensors and standard Modbus network limits. The furthest distance the MGS-410 can be from the MGS-402 controller is 1000ft (305m) when using 20 - 16AWG conductors for the sensor power and Modbus connections.

#### 3.6.1.1 Connecting the +24 VDC Terminal Block:

When using the MGS-402 as the +24VDC power source of the MGS-410 gas sensors the power should be connected the following manner.

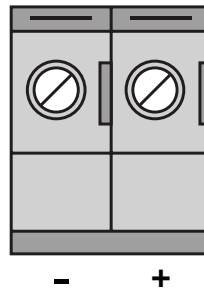
1. Locate the +24 VDC terminal block in the MGS-402 controller (*item 11 in "Figure 2-3 - MGS-402 Layout" on page 7*).
2. Using Belden 3106A or equivalent control wire feed through one of the available cable glands and connect the '+' and '-' terminals to the appropriate terminals in the MGS-402.



**NOTE:** Refer to the MGS-410 User Manual or QSG for location and connection of the corresponding +24 VDC terminal block in the MGS-410 gas sensor.

3. Reconnect +24VDC terminal to the PCB and repeat for a second MGS-410 gas sensor if needed.

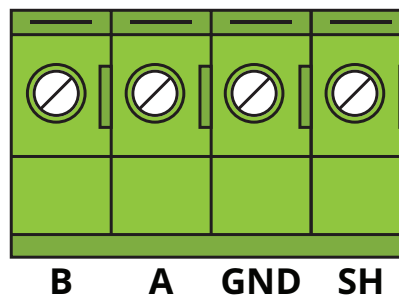
**Figure 3-2 -** +24 VDC Terminal Block



### 3.6.1.2 Connecting the Modbus network from the MGS-402 to the MGS-410

1. Locate the Modbus/Sensor terminal block in the MGS-402 controller (*item 2 in "Figure 2-3 - MGS-402 Layout" on page 7*).
2. Using one of the M16 cable glands feed the Belden 3106A or equivalent cable through the cable gland and connect to the Modbus/Sensor terminal in the following manner.
3. Connect one lead to of the twisted pair (*note wire color*) to the 'B' terminal.
4. Connect the second lead of the twisted pair to the 'A' terminal (*note wire color*).
5. Connect the ground to the 'GND' terminal and then connect the shield or drain lead to the 'SH' terminal.
6. Replace the terminal block into the MGS-402 controller.

**Figure 3-3 -** MODBUS/Sensor Terminal Block



Refer to the MGS-410 User Manual (P/N: 1100-2294) or Quick Start Guide (P/N: 1100-2290) for location and connection of the corresponding Modbus terminal block in the MGS-410 gas sensor.

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**i** **NOTE:** Ensure that the corresponding wire colors noted above are connected to the correct 'B' and 'A' terminals in the Modbus terminal block in the MGS-410 gas sensor and the ground and drain are properly terminated according to Modbus protocol.

---

## 3.6.2 Integration with Building Management System

A second Modbus connection is available in the MGS-402 to connect to a Building Management System (BMS). The physical connections are made the same as described above in section 3.6.1 but using the Modbus/BMS terminal block (item 3 in "Figure 2-3 - MGS-402 Layout" on page 7).

1. Locate the Modbus / BMS terminal block in the MGS-402.
2. Feed Belden 3106A or equivalent cable through one of the M16 cable glands (item 13 in "Figure 2-3 - MGS-402 Layout" on page 7) and connect to the appropriate terminals noting the color of the wire.
3. Make similar connections to the BMS noting wire color.
4. Controller/BMS Modbus configuration will need to be completed in section 4.2, Controller Setup.

## 3.7 Connecting External Alarms

### 3.7.1 Overview

In addition to the integrated visual and audible alarms there are several outputs available in the MGS-402 to interface with external ventilation, external equipment or for connection to a BMS or buildings fire safety panel.

There are (3) form C relay contacts rated 10A at 240VAC and (2) Analog Outputs (4-20ma, 1-5V, 2-10V). In addition there is (1) Remote Silence input to interface with a momentary push button that may be in a different location than the MGS-402. See items 1 (Analog outputs), 7-9 (Form C Relays) and 4 (Remote Silence) in "Figure 2-3 - MGS-402 Layout" on page 7.


The additional outputs should be wired in the same manner as the power and Modbus connections. Use appropriate conductor sizes on the form C relays that adhere to local building codes. The remote silence and analog outputs can be wired using Belden 3106A or equivalent cable.


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**i** **NOTE:** The relay contacts are rated 10A at 250VAC resistive load.

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## 3.8 Reinstalling MGS-402 Lid

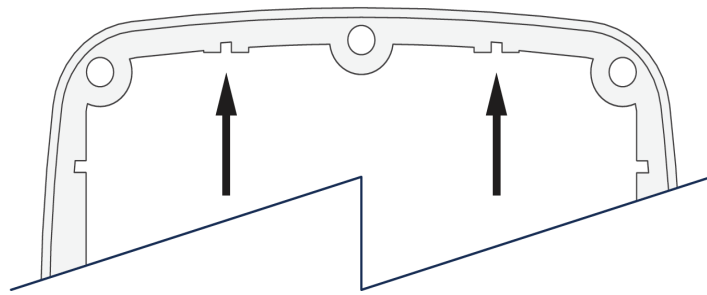
 **WARNING: DO NOT** leave excess cable inside the gas detector housing. Failure to comply may result in damage to the product.

 **CAUTION:** When installing the sensor ribbon cable, care must be taken to ensure the proper orientation of the connector at both ends of the cable. Failure to ensure proper orientation may result in loss of functionality and/or product damage.

 **NOTE:** To achieve proper seal, the lid screws should be torqued to 15 to 20 lbf in (1.5 to 2.0 Nm.)

Reinstall the rubber gasket. Ensure that it is correctly seated by placing the side with two grooves face down and the edge with two bumps on the top.


**Figure 3-4 -** Rubber Gasket



5. Reconnect the ribbon cable from the sensor to the PCBA as shown.

**Figure 3-5 -** Ribbon Cable Orientation

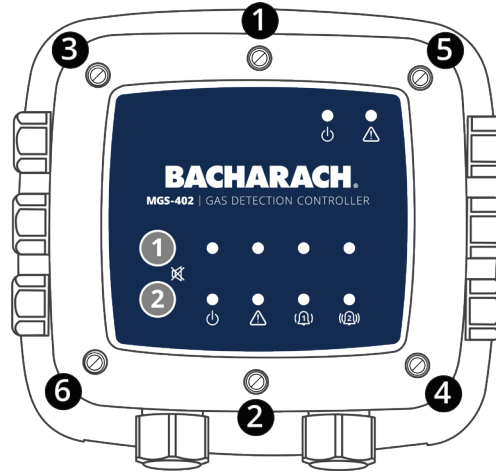


 **WARNING: DO NOT** allow the lid / sensor to hang from the ribbon cable. Failure to comply may result in damage to the product.



6. Ensure no cables are interfering with the sensor module and close the lid. Using a 5/32" (4 mm) hex key / allen wrench, tighten the lid screws in an "X" tightening pattern:

**Figure 3-6 -** Tightening Pattern



# 4. Operation

## 4.1 Overview

### 4.1.1 Main Function

Every second the MGS-402 Gas Detection Controller collects gas concentration and status information from each connected gas detector. Connection status, fault and alarm conditions are indicated by the LED matrix for each channel. Detector data and controller status information can also be communicated via Modbus, to a master or BMS device.

### 4.1.2 Power Up

During power up the perimeter visual alarm and the audible alarm will both run through a test cycle. The green Power LED for the controller (See item 2, "Figure 2 - Front Panel Layout" on page 7) will illuminate. When the MGS-402 establishes communications with the MGS-410 controllers the Fault LED for the controller (item 2, "Figure 2 - Front Panel Layout" on page 7) will go from amber to not illuminated. It can take up to 5 minutes for the MGS-410 Gas Detectors to warm up.

### 4.1.3 Channel Number Keys

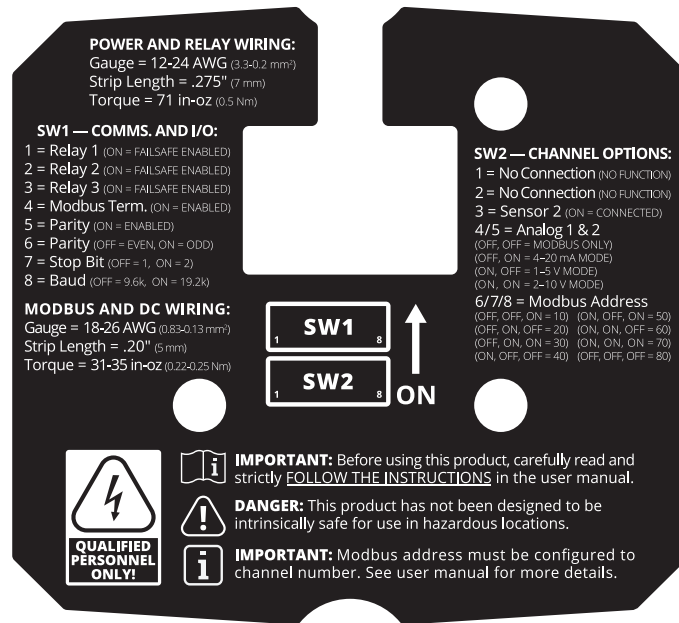
Pressing a channel number key for five-seconds on the front panel of the MGS-402 will silence an audible alarm for 30-minutes. After which time, MGS-402 will re-alarm or reset depending on whether the alarm condition still remains.

## 4.2 Controller Setup

### 4.2.1 Modbus Setup

Configure MGS-402 to BMS. If using the MGS-402 to interface with a BMS as a slave the Modbus protocol needs to be configured. (Refer to "item 3, Figure 2-3 - MGS-402 Layout" on page 6.)

Figure 4-1 - MGS-402 Back of Lid Label



Using switch 1 (SW1) on the underside of the lid of the controller use setting 4 to acknowledge whether the MGS-402 will need to have the terminating resistor engaged. Please see Modbus protocol for best practice.

Switch 1				Action
MODBUS Setting				
5	6	7	8	
OFF				Parity Disabled
ON				Parity Enabled
	OFF			Even Parity
	ON			Odd Parity
		OFF		1 Stop Bit
		ON		2 Stop Bits
			OFF	9600 Bits Per Second
			ON	19200 Bits Per Second

Switch 2			
MODBUS Address	Setting		
	6	7	8
10	OFF	OFF	ON
20	OFF	ON	OFF
30	OFF	ON	ON
40	ON	OFF	OFF
50	ON	OFF	ON
60	ON	ON	OFF
70	ON	ON	ON
80	OFF	OFF	OFF



**NOTE:** All of the above settings must match the BMS system to work correctly.

## 4.2.2 Relay Setup

Additional hardware configuration.

### 4.2.2.1 Form C Relays

The (3) form C relays that are included in the MGS-402 (*fault, low alarm, high alarm*) can be configured to be fail safe (*if power is lost on the relay it will be set to its fault or alarm state until power is restored*). The fail safe mode can be configured for each of the individual relays and is done using SW1 settings 1, 2 and 3. If fail safe mode is desirable for the form C relays change settings to ON.

### 4.2.2.2 Multiple MGS Gas Sensors

Switch 2 setting 3 is enabled if a second MGS-410 sensor will be connected to the MGS-402 (*one sensor is default*).

### 4.2.2.3 Analog Outputs

The (2) analog outputs can be configured to 4-20mA, 1-5V or 2-10V depending on preference. When configured both analog outputs will be configured the same (*i.e., both 4-20mA, both 1-5V or both 2-10V*). Using SW2 settings 4 and 5 set the desired configuration.

Condition	4-20 mA	1-5V	2-10V
Offline, Warmup	3 mA	0.75V	1.5V
Fault	1 mA	0V	0V
Under-range	3.8 mA	0.95V	1.9V
Over-range	20.5 mA	5V	10V
Normal	4-20 mA	1-5V	2-10V



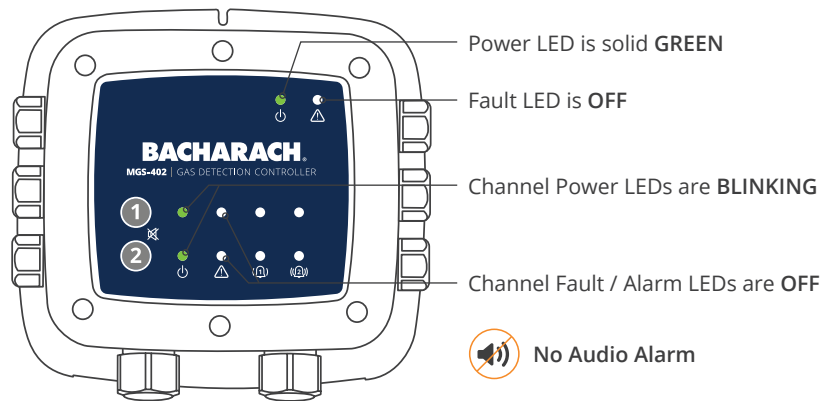
**IMPORTANT:** The Analog outputs come with a jumper installed from the factory. This ensures that the MGS-402 does not go into alarm mode upon power but before connecting the analog outputs – no signal or very small signal is a communications fault. Remove these jumpers after configuring the analog outputs.

## 4.3 Gas Detection System Test

After installation and power-up of the MGS-402 Controller, one should verify that the instrument and connected devices are functioning as intended. The following steps should be considered in the commissioning.

1. Inspect the MGS-402 Controller and verify the following:

**Figure 4-2 -** *Inspecting the MGS-402*



2. Inspect connected MGS-410 Gas Detector(s) and verify the following:

**Figure 4-3 -** *Inspecting Connected MGS-410*



3. If applicable, verify that any monitoring device(s) connected to the MGS-402's analog output is receiving the proper signal from the controller.
4. If applicable, verify that any Modbus BMS Master device(s) are communicating properly with the MGS-402 controller.
5. If applicable, verify any peripheral device(s) which are connected to the MGS-402's relays are operating as intended in a normal / non-alarm status.



**CAUTION:** The following System Check is intended to reproduce the full function of the gas detection system in its alarm state. The individual conducting the test should be aware these alarm responses; including audio / visual alarms, peripheral devices and / or any equipment shutdown processes prior to starting the test. Any adverse consequences resulting from simulating a system alarm response should be anticipated and mitigated before starting the test. Always follow local procedures / policy when conducting a gas detection system test.

7. As a final system commissioning step, apply calibration span gas to the connected MGS-410 Refrigerant Detector(s) so to place them into an alarm state. Verify the proper function of the MGS-402 and MGS-410 audio / visual alarm functions as well as verify the proper function of connected relay peripherals and analog and Modbus monitoring devices.

Though Bacharach recommends a full system test with calibration span gas, there may be circumstances where the customer wishes to check the relay peripheral device function without applying span gas. This can be accomplished through the following steps:

- Power off the MGS-402 Controller
- Remove the front cover and change the DIP Switch selection for the relay state to the opposite of the intended function. SWITCH #1 (*For instance, if FAIL SAFE Operation is ENABLED, then DISABLE it*).
- Replace the front cover and return power to the MGS-402 Controller.
- After warm up, verify that the relay peripheral devices are in their intended alarm / fault state.
- Remove power to the MGS-402, and return the relay switches (*SWITCH #1*) to their original state.
- Replace the front cover and return power to the MGS-402.
- After warm up, verify that the relay peripheral devices are in their normal, non-alarm state.

# 5. Modbus

## 5.1 Modbus Overview

Modbus RTU protocol is utilized both for down line detector communication and up line BMS communication. Communication parameters may be set via the configuration switches.

The MGS-402 controller acts as a Modbus master device on the detector side, and as a Modbus slave device on the BMS side. Refer to the MODBUS tables found on page 15.

### 5.1.1 SLAVE NODE ADDRESS

This is the Modbus node address (10, 20, 30, 40, 50, 60, 70 or 80) that the upstream BMS will need to use when sending queries to the controller.

### 5.1.2 SLAVE BAUD RATE

The MGS-402 controller will use this baud rate to communicate with the upstream BMS or Modbus master device, either 9600 (*default*) or 19200.

### 5.1.3 SLAVE PARITY

This PARITY setting should match the BMS PARITY (*NONE, EVEN or ODD*).

### 5.1.4 SLAVE STOP BIT

The number of stop bits (1 or 2) must match the BMS setting.

### 5.1.5 SLAVE TERMINATION

A 120 ohm termination resistor can be enabled on the BMS connection. This is typically only required for cable lengths in excess of 1,000 ft (304 m), for shorter distances set this termination to OUT.

## 5.2 Modbus Registers

Read	Write	Register Address	Func Code 04 (read input registers)	Item Group	Notes
R	X	30001	Sensor 1 is monitored flag	Sensor 1	0 = Not Monitored 1 = Monitored
R	X	30002	Sensor 1 communication status	Sensor 1	1 = Normal 2 = Failsafe

Read	Write	Register Address	Func Code 04 (read input registers)	Item Group	Notes
R	X	30003	Sensor 1 Modbus error code	Sensor 1	Exception code from Modbus standard
R	X	30004	Sensor 1 concentration	Sensor 1	0-65535
R	X	30005	Sensor 1 status code	Sensor 1	0 = Offline 1 = Warm-up 2 = Online
R	X	30006	Sensor 1 Fault code ( <i>high byte</i> )	Sensor 1	Sensor specific
R	X	30007	Sensor 1 sensor fault code	Sensor 1	Sensor specific
R	X	30008	Sensor 1 ° C	Sensor 1	Sensor specific
R	X	30009	Sensor 1 Cal expired flag	Sensor 1	0 = Cal Valid 1 = Cal expired
R	X	30010	Sensor 1 Low alarm flag	Sensor 1	0 = No Alarm 1 = Alarm
R	X	30011	Sensor 1 High alarm flag	Sensor 1	0 = No alarm 1 = Alarm
R	X	30012	Sensor 1 Saturation flag	Sensor 1	0 = Unsaturated 1 = Saturated
R	X	30013	Sensor 1 Underflow flag	Sensor 1	0 = Normal 1 = Underflow
R	X	30014	Sensor 1 Instrument Type code	Sensor 1	1 = MGS400
R	W	30015	Sensor 1 Node Address	Sensor 1	1-254
R	X	30016	Sensor 1 Sensor Type code	Sensor 1	Sensor specific
R	X	30017	Sensor 1 Concentration Units	Sensor 1	1 = ppm 2 = ppb 3 = %VOL 4 = %LEL
R	X	30018	Sensor 1 Scale Factor	Sensor 1	Power of 10 used on concentration, divide conc by 10 <sup>x</sup> for
R	X	30019	Sensor 1 Gas Type Text Char 1,2	Sensor 1	ASCII characters
R	X	30020	Sensor 1 Gas Type Text Char 3,4	Sensor 1	ASCII characters
R	X	30021	Sensor 1 Gas Type Text Char 5,6	Sensor 1	ASCII characters
R	X	30022	Sensor 1 Gas Type Text Char 7,8	Sensor 1	ASCII characters
R	X	30023	Sensor 1 Gas Type Text Char 9,10	Sensor 1	ASCII characters
R	X	30024	Sensor 1 SID Text Char 1,2	Sensor 1	ASCII characters
R	X	30025	Sensor 1 SID Text Char 3,4	Sensor 1	ASCII characters
R	X	30026	Sensor 1 SID Text Char 5,6	Sensor 1	ASCII characters



Read	Write	Register Address	Func Code 04 (read input registers)	Item Group	Notes
R	X	30027	Sensor 1 SID Text Char 7,8	Sensor 1	ASCII characters
R	X	30028	Sensor 1 UID Text Char 1,2	Sensor 1	ASCII characters
R	X	30029	Sensor 1 UID Text Char 3,4	Sensor 1	ASCII characters
R	X	30030	Sensor 1 UID Text Char 5,6	Sensor 1	ASCII characters
R	X	30031	Sensor 1 UID Text Char 7,8	Sensor 1	ASCII characters
R	X	30032	Sensor 1 Alias Text Char 1,2	Sensor 1	ASCII characters
R	X	30033	Sensor 1 Alias Text Char 3,4	Sensor 1	ASCII characters
R	X	30034	Sensor 1 Alias Text Char 5,6	Sensor 1	ASCII characters
R	X	30035	Sensor 1 Alias Text Char 7,8	Sensor 1	ASCII characters
R	X	30036	Sensor 1 Alias Text Char 9,10	Sensor 1	ASCII characters
R	X	30037	Sensor 1 Alias Text Char 11,12	Sensor 1	ASCII characters
R	X	30038	Sensor 1 Alias Text Char 13,14	Sensor 1	ASCII characters
R	X	30039	Sensor 1 Alias Text Char 15,16	Sensor 1	ASCII characters
R	X	30051-30100	SENSOR 2 DATA GROUP <i>(REPEAT OF SENSOR1)</i>	Sensor 2	
R	X	31000	Sensor 1 Concentration	Sensor 1	
R	X	31001	Sensor 2 Concentration	Sensor 2	
R	X	31032	Sensor 1 Fault code <i>(high bytes)</i>	Sensor 1	
R	X	31033	Sensor 1 Fault code	Sensor 1	
R	X	31034	Sensor 2 Fault code <i>(high bytes)</i>	Sensor 2	
R	X	31035	Sensor 2 Fault code	Sensor 2	

Read	Write	Register Address	Func Code 03/06 (Read/preset)	Item Group	Notes
R	X	40002	RS-485 Node Address	Controller-related	1-254
R	X	40003	Baud Rate	Controller-related	0 = 9600 1 = 19200
R	X	40004	Stop Bits	Controller-related	1 or 2

Read	Write	Register Address	Func Code 03/06 (Read/preset)	Item Group	Notes
R	W	40005	Parity	Controller-related	0 = None 1 = Odd 2 = Even
R	X	40006	Controller UID Char 1,2	Controller-related	ASCII characters
R	W	40007	Controller UID Char 3,4	Controller-related	ASCII characters
R	W	40008	Controller UID Char 5,6	Controller-related	ASCII characters
R	W	40009	Controller UID Char 7,8	Controller-related	ASCII characters
R	X	40010	16 bit Current Fault Code Controller	Controller-related	0-65535
R	X	40011	16 bit Last Fault Code Controller	Controller-related	0-65535
R	X	40012	Software Version Major	Controller-related	0-255
R	X	40013	Software Version Minor	Controller-related	0-255
R	X	40014	Software Version Build	Controller-related	0-255
R	W	40015	Relay 1 Contact Behavior / Failsafe	Controller-related	0 = Normal 1 = Failsafe
R	W	40016	Relay 2 Contact Behavior / Failsafe	Controller-related	0 = Normal 1 = Failsafe
R	W	40017	Relay 3 Contact Behavior / Failsafe	Controller-related	0 = Normal 1 = Failsafe
R	X	40018	24V supply voltage x 100	Diagnostics	2400 = 24.00V
R	X	40019	24V supply output to sensors voltage x 100	Diagnostics	2400 = 24.00V
R	X	40020	Battery voltage x 100	Diagnostics	300 = 3.0V
R	X	40021	Controller 3.3V supply voltage x100	Diagnostics	330 = 3.30V
R	X	40022	Controller temperature x100	Diagnostics	2500 = 25.00degC
R	X	40023	Controller tact and mag switch state	Diagnostics	Sum of activated switch values
R	W	40024	Buzzer enable	Controller-related	0 = Disabled 1 = Enabled
R	W	40026	Fault Latching Enabled	Controller-related	0 = Disabled 1 = Enabled

Read	Write	Register Address	Func Code 02 (read input status)	Type	Item Group
R	X	10001	Sensor 1 Low Alarm Flag (0 or 1 = alarm)		Sensor 1
R	X	10002	Sensor 2 Low Alarm Flag (0 or 1 = alarm)		Sensor 2
R	X	10003	Sensor 1 High Alarm Flag (0 or 1 = alarm)		Sensor 1
R	X	10004	Sensor 2 High Alarm Flag (0 or 1 = alarm)		Sensor 2
R	X	10005	Sensor 1 Any Alarm Flag (0 or 1 = alarm)		Sensor 1
R	X	10006	Sensor 2 Any Alarm Flag (0 or 1 = alarm)		Sensor 2
R	X	10007	Sensor 1 Fault Flag (0 or 1 = fault)		Sensor 1
R	X	10008	Sensor 2 Fault Flag (0 or 1 = fault)		Sensor 2
R	W	10009	Sensor 1 enabled flag (0=disabled 1=enabled)		Sensor 1
R	X	10200	Relay 1 State (0 or 1 = energized)		Controller-related
R	X	10201	Relay 2 State (0 or 1 = energized)		Controller-related
R	X	10202	Relay 3 State (0 or 1 = energized)		Controller-related

# 6. Diagnostics & Troubleshooting

## 6.1 FAULT CODES

Code	Critical Fault	Possible Causes	Remedy
0001	CHASSIS TEMP	Chassis temperature outside the range of -40 to +50C	Reduce ambient temperature or check for power supply malfunction.
0002	RS485 MSTR BUFR	Buffer overflow communicating with detectors	Disable all but one channel, use Modbus MASTER traffic screen to one CH at a time.
0004	RS485 SLAVE BUFR	Buffer overflow communicating with BMS	Use Modbus SLAVE traffic screen to diagnose.
0008	RS485 MSTR CRC	CRC error communicating with detectors	Disable all but one channel, use Modbus MASTER traffic screen to one CH at a time.
0010	RS485 SLAVE CRC	CRC error communicating with BMS	Use Modbus SLAVE traffic screen to diagnose.
0040	RS485 SL TMOU	Modbus timeout communicating with BMS	Use Modbus SLAVE traffic screen to diagnose.
0200	STUCK KEY ERROR	On or more keys on the keypad are stuck down	Use KEYPAD TEST to determine stuck key, consult factory.
0400	CONFIG ERROR	All detectors are disabled or there are duplicate node addresses	Enable one or more channels, or check for duplicate node address assignment.
1000	SENSOR RESPONSE	One or more detectors are not responding to queries	Disable all but one channel, use Modbus MASTER traffic screen to test one CH at a time
2000	SUPPLY VOLTS ERR	One or more power supply voltages are out of range	Check POWER screen in diagnostic menu, if SUPPLY OUT is <23.7V check for short or overload on detector supply feed.
4000	CPU ERROR	Microcontroller malfunction	Reset or reboot controller, if fault persist, consult factory.
8000	EEPROM ERROR	EEPROM malfunction	Consult factory.

# 7. Additional Information

## 7.1 Disposing of Instrument

EU-wide regulations governing the disposal of electrical and electronic appliances which have been defined in the EU Directive 2012/19/EU and in national laws have been effective since August 2012 and apply to this device.

Common household appliances can be disposed of using special collecting and recycling facilities. However, this device has not been registered for household usage. Therefore it must not be disposed of through these channels. The device can be returned to your national Bacharach Sales Organization for disposal. Contact Bacharach if you have any questions.

## 7.2 Technical Specifications

Product Attributes	Description
Operating Temperature	-40° F - +122° F (-40° C - +50° C)
User Interface	Front panel push buttons; DIP switches
Common Alarm Relays	1 × Low Alarm (10 A) @ 250 VAC 1 × High Alarm (10 A) @ 250 VAC
Fault Alarm Relays	1 × Fault (10 A) @ 250 VAC
Analog Output	2 × Configurable 4-20 mA, 1-5, 2-10 VDC
Alarm Silence	2 × Front Panel Push Buttons 1 × Auxiliary Input
Serial Ports	1 × RS485 Modbus RTU Slave for BMS/BAS 1 × RS485 Modbus RTU Master for Gas Detectors
Power	100-240 VAC, 50/60 HZ, 20W (max)
Size (W×H×D) Approximate	6.5" × 6.5" × 3.4" (165 × 165 × 87 mm)
Weight Approximate	1 lb. 11.07 oz (758 g)
Cable Entries	2 × M20 / 0.5" Conduit (Power) 6 × M16 Cable Glands (Communications or Power)
Approvals	CE, UL/CSA/IEC EN 61010-1

# 8. Parts and Accessories

## 8.1 Part Numbers

Part #	Description
6702-8020	MGS-402 Controller

## 8.2 Service Center Locations

Prior to shipping equipment to Bacharach, visit [www.mybacharach.com](http://www.mybacharach.com) for a Returned Merchandise Authorization Number (RMA #). All returned goods must be accompanied by a RMA #. Pack the equipment securely (*in its original packing, if possible*), as Bacharach cannot be held responsible for any damage incurred during shipping to our facility.

Location	Contact Information	Shipping Address
United States	Phone: +1 724 334 5000 Toll Free: +1 800 736 4666 Fax: +1 724 334 5001 Email: <a href="mailto:help@mybacharach.com">help@mybacharach.com</a>	Bacharach, Inc. 621 Hunt Valley Circle New Kensington, PA 15068, USA ATTN: Service Department
Europe	Phone: +353 1 284 6388 Fax: +353 1 284 6389 Email: <a href="mailto:help@mybacharach.com">help@mybacharach.com</a>	Bacharach, Inc. Unit D12 & D13 Santry Business Park, Swords Road Santry, Dublin, Ireland ATTN: Service Department
Canada	Phone: +1 905 882 8985 Fax: +1 905 882 8963 Email: <a href="mailto:support@bachcan.ca">support@bachcan.ca</a>	Bacharach, Inc. 10 West Pearce Street, Unit 4 Richmond Hill, Ontario. L4B 1B6, Canada ATTN: Service Department

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THE MEASURABLE DIFFERENCE

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